

REMARKS

Grounds of Rejection

Claims 1-8 have been rejected under 35 USC §103(a) as being unpatentable over Kuipers et al. (US Patent No. 6,852,307 B1) in view of Acker (US Patent No. 6,322,917 B1).

Claims 9-15 have been rejected under 35 USC §102(e) as being anticipated by Skala et al. (US 2002/0094461 A1).

Claims 16-20 have been rejected under 35 USC §103(a) as being unpatentable over Acker (US Patent No. 6,322,917 B1).

The 35 USC §102(e) and 35 USC §103(a) rejections are traversed for the reasons to follow.

Summary Of The Claimed Subject Matter

Claims 1-20 are directed to processes for operating hydrogen generators, particularly hydrogen generators configured to supply fuel cells.

As claimed in amended claim 1, a process can include the step of "providing raw materials into the generator to meet a hydrogen production rate demand of the generator". The process can also include the step of "reforming hydrocarbon feed in the presence of steam to produce a reformat comprising hydrogen, carbon monoxide and carbon dioxide". The process can also include the steps of "converting at least some of the carbon monoxide in the reformat to carbon dioxide using water gas shift and selective oxidation processes", and "at least partially combusting the hydrocarbon feed with the oxygen gas to provide heat for the reforming step". The process can also include the steps of "determining conditions of the generator including at least process temperatures" and "determining conditions of the raw materials". The process can also include the steps of "selecting predetermined feed rates for the raw materials using the conditions of the generator, the conditions of the raw materials and a look up table of predetermined values", and "controlling a feed rate of each of the raw materials to substantially the predetermined feed rates".

Amended independent claim 9 recites essentially the same process as claim 1 but in

combination with the steps of: "performing a transition rate-limiting operation", and "controlling a rate of change of the feed rate of each of the raw materials in accordance with a predetermined rate commensurate with the rate of change in the transition rate-limiting operation".

Amended independent claim 16 recites the process in the context of providing low levels of carbon monoxide.

35 USC §103(a) Rejections Of Claims 1-8 Over Kuipers et al. and Acker

The 35 USC §103(a) rejections of claims 1-8 are traversed because the claims *taken as a whole* are unobvious over the prior art *taken as a whole*. The test for obviousness is whether the teachings of the prior art, *taken as a whole*, would have made obvious the claimed invention. See *In re Young*, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991); *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 88 (CCPA 1981).

Kuipers et al. is directed to a catalytic oxidation process in which a hydrocarbon fuel in line 1 and an oxygen gas in line 2 are mixed and introduced into a catalyst bed 3 (column 2, lines 44-46). In addition, the flow rates of the hydrocarbon fuel and of the oxygen gas are set in accordance with predetermined values using adjusting means 4 and 5 (column 2, lines 46-50). The adjusting means are operated responsive to the hydrogen demand (column 2, lines 50-54).

However, Kuipers et al. is fundamentally different than the present process because it is a feedback process, rather than a feed forward process. In this respect, the Kuipers et al. process adjusts the feed rate of the hydrocarbon fuel 1 and the oxygen gas 2, as a function of the hydrogen demand. The Kuipers et al. process looks back rather than forward to adjust the feed rate. In addition, there is no consideration of the conditions of the catalyst bed 3, and no consideration (other than flow rate) for the conditions of the hydrocarbon fuel 1 and the oxygen gas 2.

In contrast, the present process determines both the conditions in the generator and the conditions of the raw materials. The process looks forward to the generator and the raw material, and also looks backward to a specific hydrogen production rate. In order to emphasize this difference, claim 1 has been amended to recite the step of "determining conditions in the generator including at least process temperatures", and the step of

"determining conditions of the raw materials". Antecedent basis for the "condition" recitations is contained in paragraph [0019] of the specification. Antecedent basis for the temperature recitation is contained in paragraph [0067] and [0072] of the specification.

Acker was cited as disclosing a hydrogen generator having a reformer 3, a shift reactor 40 and a PROX reactor 50. Acker was also cited as disclosing raw materials which include a hydrocarbon fuel 120, steam 130 and air 140 (column 6, lines 14-43).

However, the combination of Acker with Kuipers et al. does not suggest the concept of feed forward control. Admittedly, there is prior art in which operational conditions of a steam reformer are monitored. However, the present process provides the additional insight of relating these conditions, and the conditions of the raw materials as well, to a look up table of predetermined values at specific hydrogen production rates. This allows more process control for hydrogen production, which is an indicia of the unobviousness of the claimed process.

These rejections are further traversed as one skilled in the art at the time of the invention would have no reason to combine Kuipers et al. and Acker in the manner of the Office Action. Under the criteria established by *KSR Int'l Co., v. Teleflex, Inc.*, No 04-1350 (U.S. Apr. 30, 2007), in formulating rejections under 35 USC §103(a) it remains necessary to identify a reason why a person of ordinary skill in the art at the time of the invention would have combined references.

The Office Action states the reason for the combination as: "since Acker reference states at Column 6, Lines 39-42 that such a modification would reduce the level of carbon monoxide in the reformed fuel mixture to below 5-100ppm" (column 6, lines 39-42). However, the Kuipers et al. process produces CO with no concern for CO₂ (column 1, lines 11-16). One skilled in the art would thus not be inclined to combine the references in the manner of the Office Action because there is no CO₂ to reduce.

35 USC §102(e) Rejections Of Claims 9-15 Over Skala et al.

The 35 USC §102(e) rejections of claim 9-15 over Skala et al. are traversed as the cited reference does not disclose or enable all of the features of the claimed process. A proper 35 USC §102(e) rejection requires that each and every limitation of the claimed invention be disclosed in a single prior art reference. In addition, the reference must be

enabling and describe the applicant's claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention. *In re David C. Paulsen*, 30 F.3d 1475, 31 USPQ 2d (BNA) 1671, (U.S. App 1994).

Skala et al. is directed to a method for controlling the oxidant injection to a reactor (abstract). Paragraph [0004] was cited in the Office Action as disclosing a rate limiting operation (vehicle fuel). Paragraph [0030] was cited in the Office Action as disclosing changes in flow rate into the reformer are proportional to changes in flow rate out of the reformer.

However, Applicant is unable to locate any teachings in Skala that relate the changes in flow rate to "a predetermined rate commensurate with the rate of change in the transition rate-limiting operation" as recited in independent claim 9. Accordingly, claim 9 is submitted to be novel over Skala.

In addition, independent claim 9 has been amended with additional recitations which further distinguish the claimed process from the prior art. In particular, claim 9 has been amended to include recitations similar to amended claim 1 which were discussed in the previous rejections. These recitations are in combination with the step of "controlling the rate of change of the feed rate". In view of the non-disclosure of these features amended claim 9 is submitted to be novel and unobvious over the prior art.

Independent claim 11 has been canceled. In addition, dependent claims 12-15 have been amended to depend on claim 9.

35 USC §103(a) Rejections Of Claims 16-20 Over Acker

The 35 USC §103(a) rejections of claims 16-20 over Acker are traversed as the cited reference does not disclose or suggest all of the limitations of the claimed process. For a proper 35 USC §103(a) rejection, MPEP 2142, 2143 specifies that the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The Office Action recognizes that Acker does not disclose all of the claim limitations, but states that it would be obvious to modify the claimed process to optimize process variables. Applicant respectfully disagrees with this assessment, as independent claim 16 recites a detailed process for optimizing process variables, which is not disclosed or suggested by the prior art.

In particular, claim 16 recites the limitation of: "said algorithm comprises determining a target hydrocarbon fuel flow (B) and a current hydrocarbon fuel flow (A), then determining a present difference $(D)=(B)-(A)$, and then comparing said difference (D) with a predetermined threshold value to determine whether said fuel processor is turning up production of hydrogen, turning down production of hydrogen or operating at a steady state mode and wherein a higher ratio of water to fuel and air to fuel is added when said fuel processor is turning up production for a preset period of time than when said fuel processor is operating at a steady state mode and wherein a lower ratio of water to fuel and air to fuel is added when said fuel processor is in a turning down of production mode".

Claim 16 thus provides a formula for obtaining the algorithm, and a process sequence for using the algorithm to reduce carbon monoxide during operation of a hydrogen generator. In view of these undisclosed limitations, and the improved results provided by the claimed process, claims 16-20 are submitted to be novel and unobvious over the prior art.

Conclusion

In view of the amendments and arguments, favorable consideration and allowance of claims 1-10 and 12-20 is requested. A Petition For Extension Of Time (30 day) is being filed concurrently with this Amendment.

In addition, an Associate Power Of Attorney appointing the undersigned is being filed concurrently with this Amendment. Please change the address for correspondence to the address associated with Customer No. 22823.

Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

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